Army
CERs For Base Operation Services

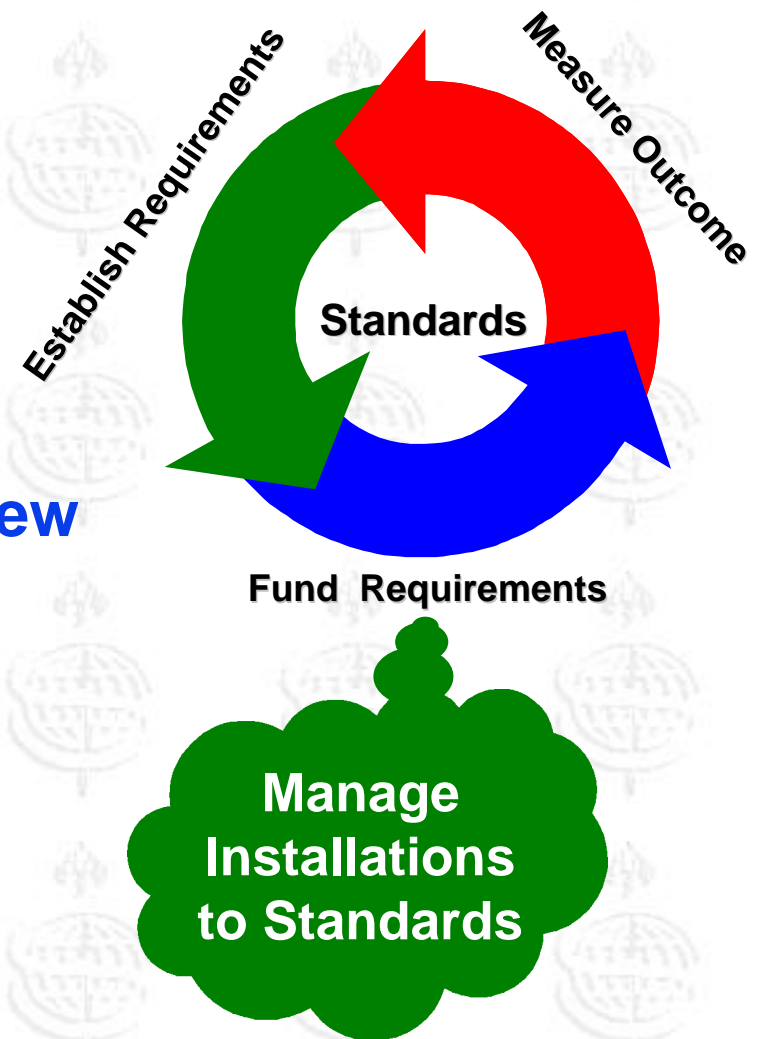### Mr. Stephen Bagby
Ms. Cecile Batchelor

www.ceac.army.mil

Subjects Covered

✓ **Customer Challenge:** *Connect Resources to Outcome Measured Against Standards*

✓ **Installation System Overview**
- **Service Structure**
- **Data Collection**

✓ **SSC CER Methodology**
- **Process**
- **Results**

Establish Requirements

Measure Outcome

Standards

Fund Requirements

Manage Installations to Standards

Army Installation Management
Headquarters Information

125 Installations

Based On Historical Expenditures

A **Model** That:

- **Generates Requirements for the POM**
- **Covers Base Operations Support Services & Real Property Maintenance**
- **Provides HQDA Programming Tool**

Installation Status Report (ISR)
The ISR Assesses Quality and Quantity Against Defined Standards

Facilities — **Facility Condition Versus Standard**
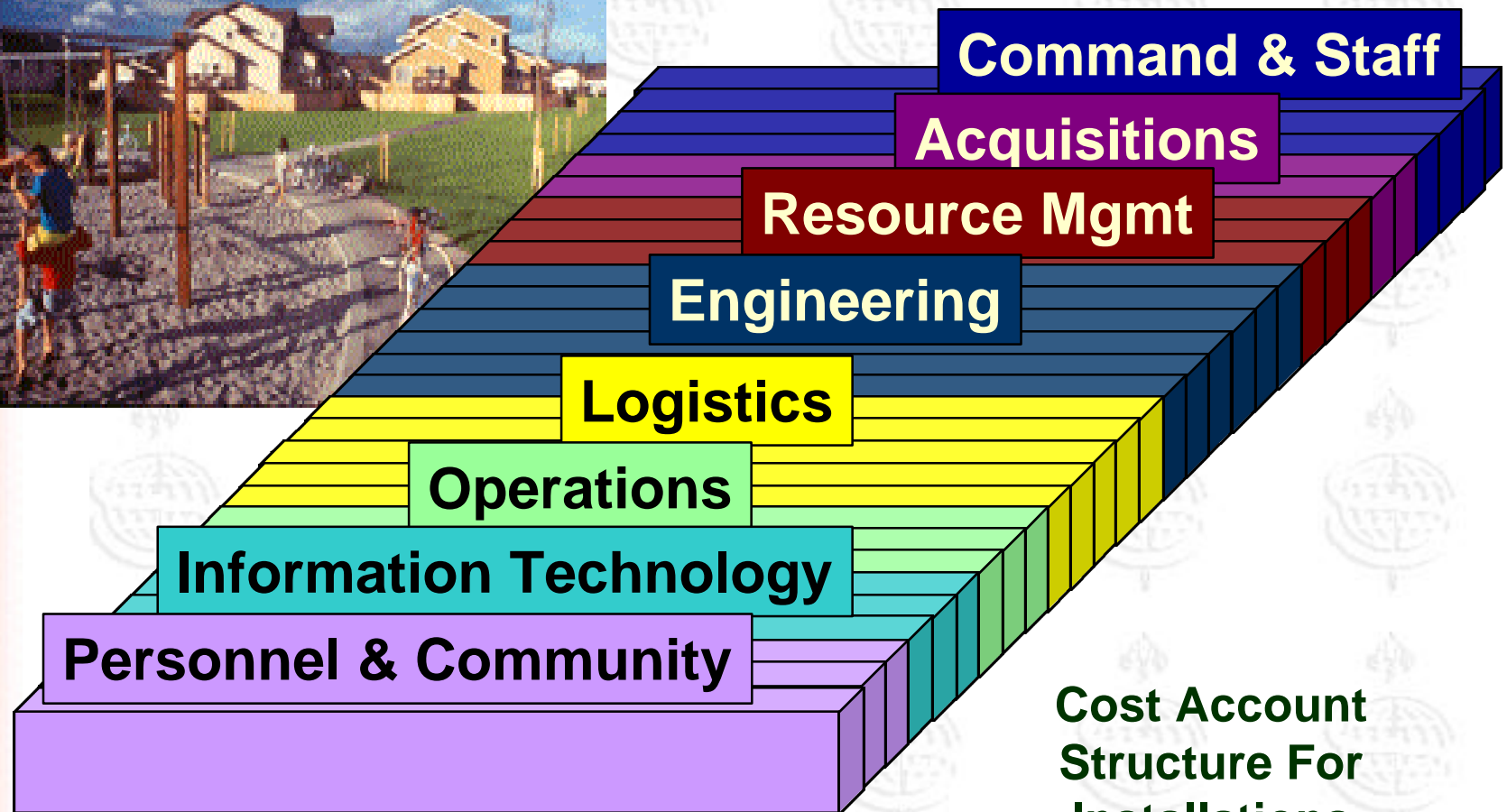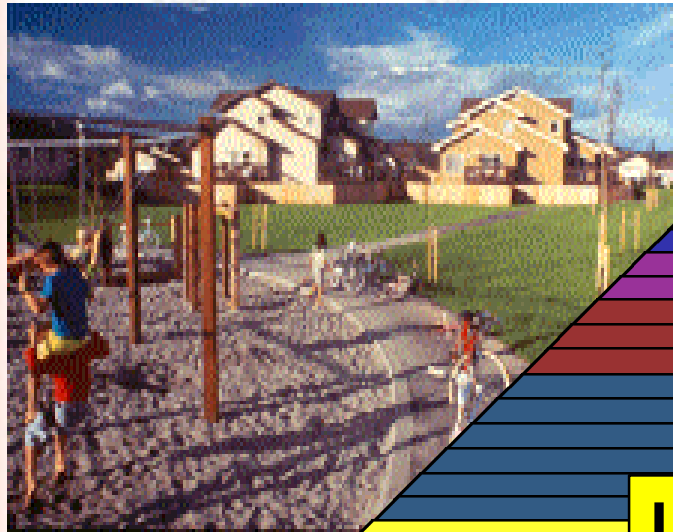
Environment — **How Well Programs are Being Managed**

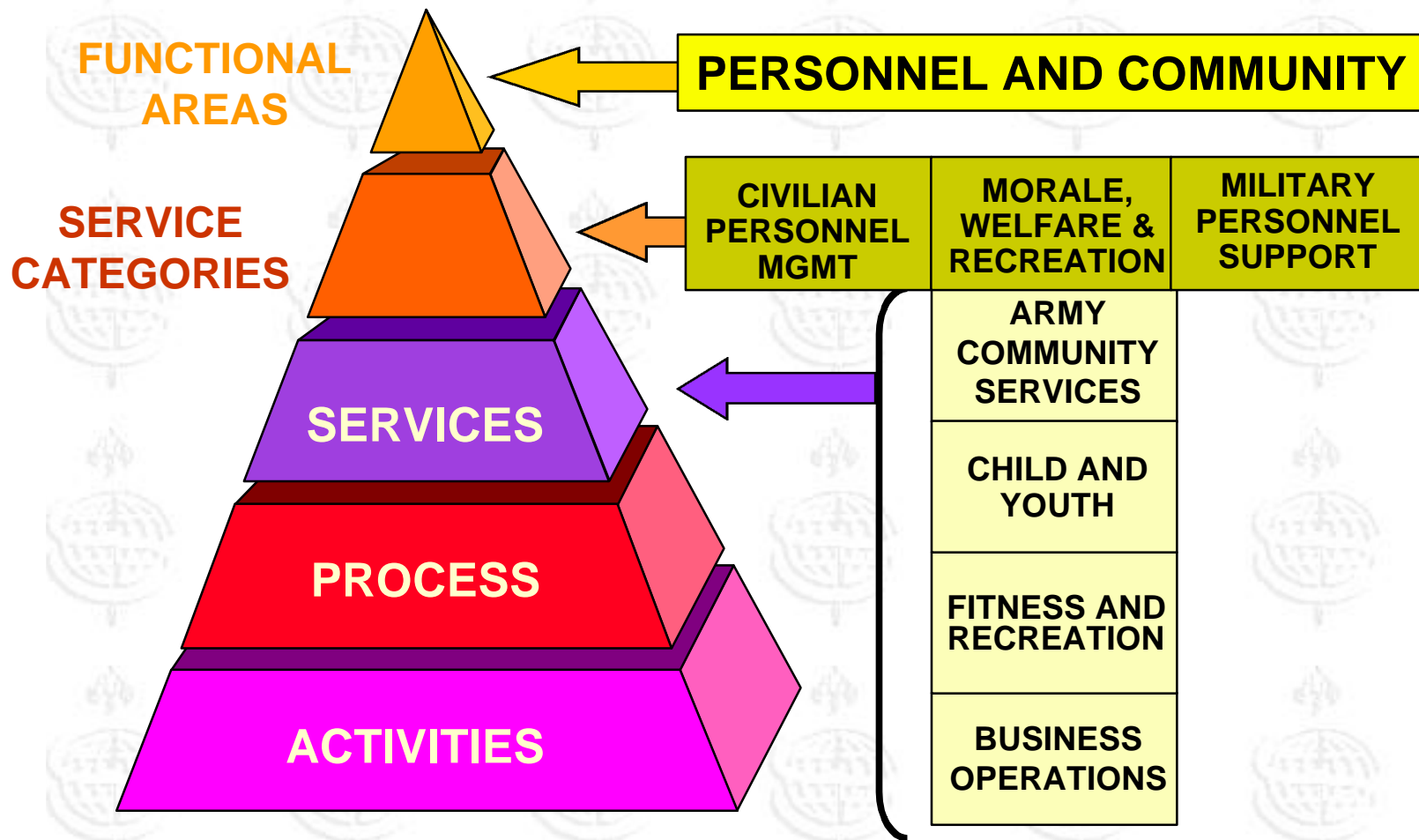**Services** — **How Well Service is Being Performed**

Base Operation Services
Create Chart of Accounts

U.S. Army Cost & Economic Analysis Center

Command & Staff

Acquisitions

Resource Mgmt

Engineering

Logistics

Operations

Information Technology

Personnel & Community

Cost Account Structure For Installations

A Strategy To Aggregate Data

FUNCTIONAL AREAS

SERVICE CATEGORIES

SERVICES

PROCESS

ACTIVITIES

PERSONNEL AND COMMUNITY

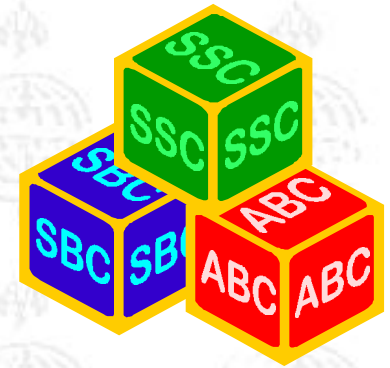| CIVILIAN PERSONNEL MGMT	MORALE, WELFARE & RECREATION	MILITARY PERSONNEL SUPPORT

ARMY COMMUNITY SERVICES

CHILD AND YOUTH

FITNESS AND RECREATION

BUSINESS OPERATIONS

"What gets measured gets done..."

Cost Methodologies

✓ **STANDARD SERVICE COSTING (SSC)**
→ A STANDARD COST FOR AN <u>EXPECTED LEVEL OF PERFORMANCE</u>

✓ **SERVICE BASED COSTING (SBC)**
→ MEASURES THE COSTS INCURRED TO PROVIDE A <u>SERVICE</u> AND THE <u>OUTPUT</u> PRODUCED

✓ **ACTIVITY BASED COSTING (ABC)**
→ A METHOD OF MEASURING THE CONSUMPTION OF RESOURCES BY <u>ACTIVITIES</u> AND THE CONSUMPTION OF ACTIVITIES BY A <u>SERVICE</u>

Performance Measures
Types

RELATE TO COST

Output Measures

- **Quantity Measures**
  - ✓ Number of Transportation Requests
  - ✓ Number of Installation-owned non-Tactical Vehicles

Outcome Measures

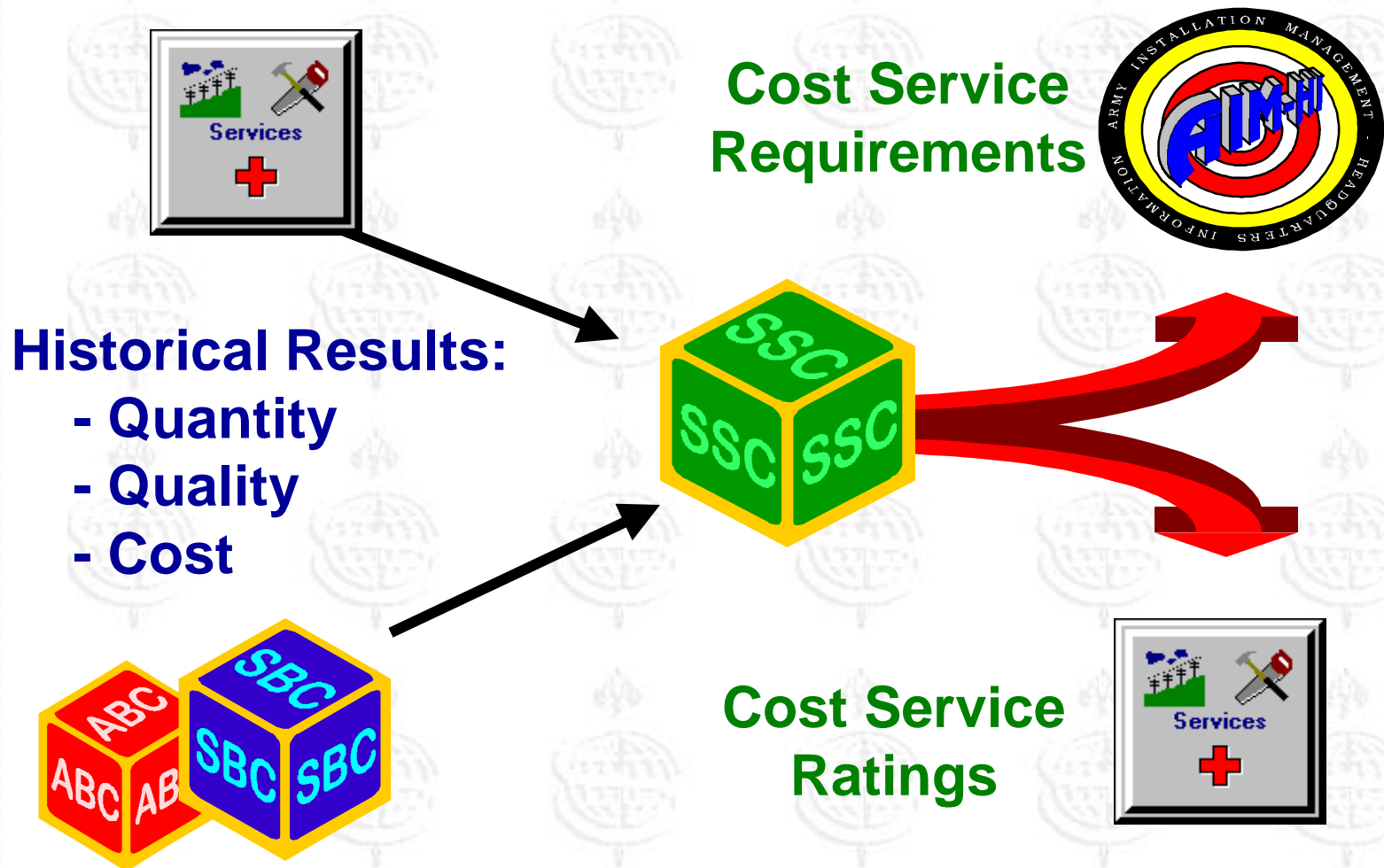- **Quality Performance Measures**
  - ✓ Days Storage-in-Transit

NOT RELATED TO COST

Outcome Measures

- **Management Quality Performance Measures**
  - ✓ Percentage Increase in Education Level
  - ✓ Average Response Time to Incidents
  - ✓ Met your CYS Participation Rate?

Service Data / Estimating System Concept

U.S. Army Cost & Economic Analysis Center

Services

Cost Service Requirements

AIM-HI

ARMY INSTALLATION MANAGEMENT · HEADQUARTERS INFORMATION

Historical Results:
- **Quantity**
- **Quality**
- **Cost**

SSC
SSC SSC

ABC ABC AB
SBC SBC SBC

Cost Service Ratings

Services

Standard Service Costing
Predictive Cost

- **Predictive Functions(s) To Estimate An Expected Level Of Service Performance**

- **CERs Based on relationship to Quantity and Quality Variables**

SSC Cost Analysis

Cost

Green Cost Function

Amber Cost Function

Performance

Red Cost Function
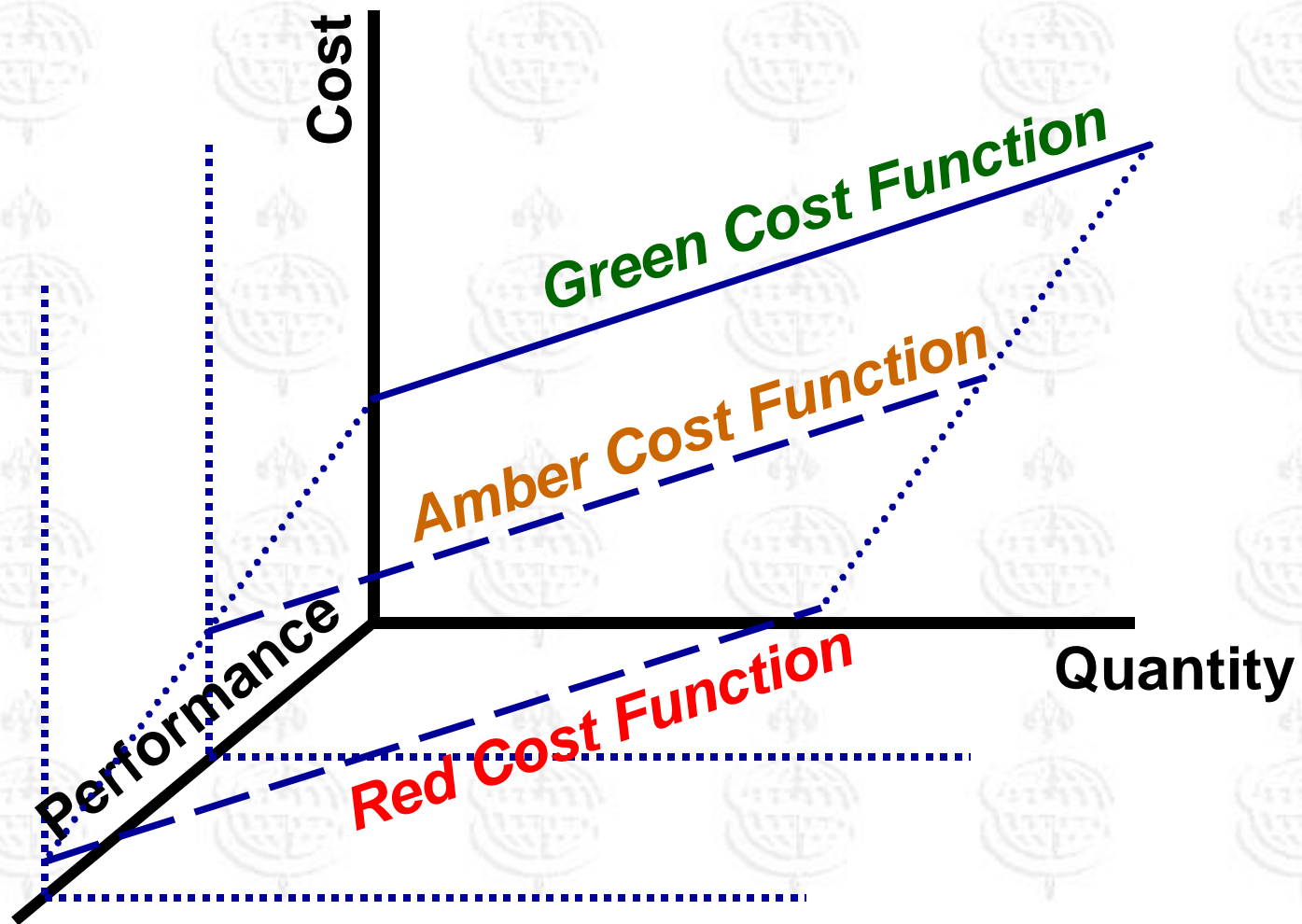
Quantity

COST FUNCTION

Installation: Ft Campbell

Service: Laundry & Dry Cleaning

Formula: $y = a + bx + q$

Attributes (Size, Mission, Location, Population, Facility Footprint, Type)
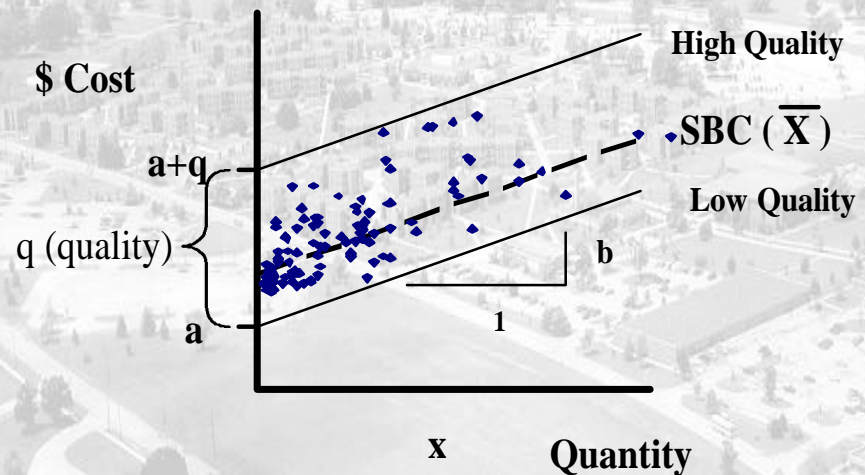
y = Resources Required
a = Fixed Costs
b = Variable Unit Cost
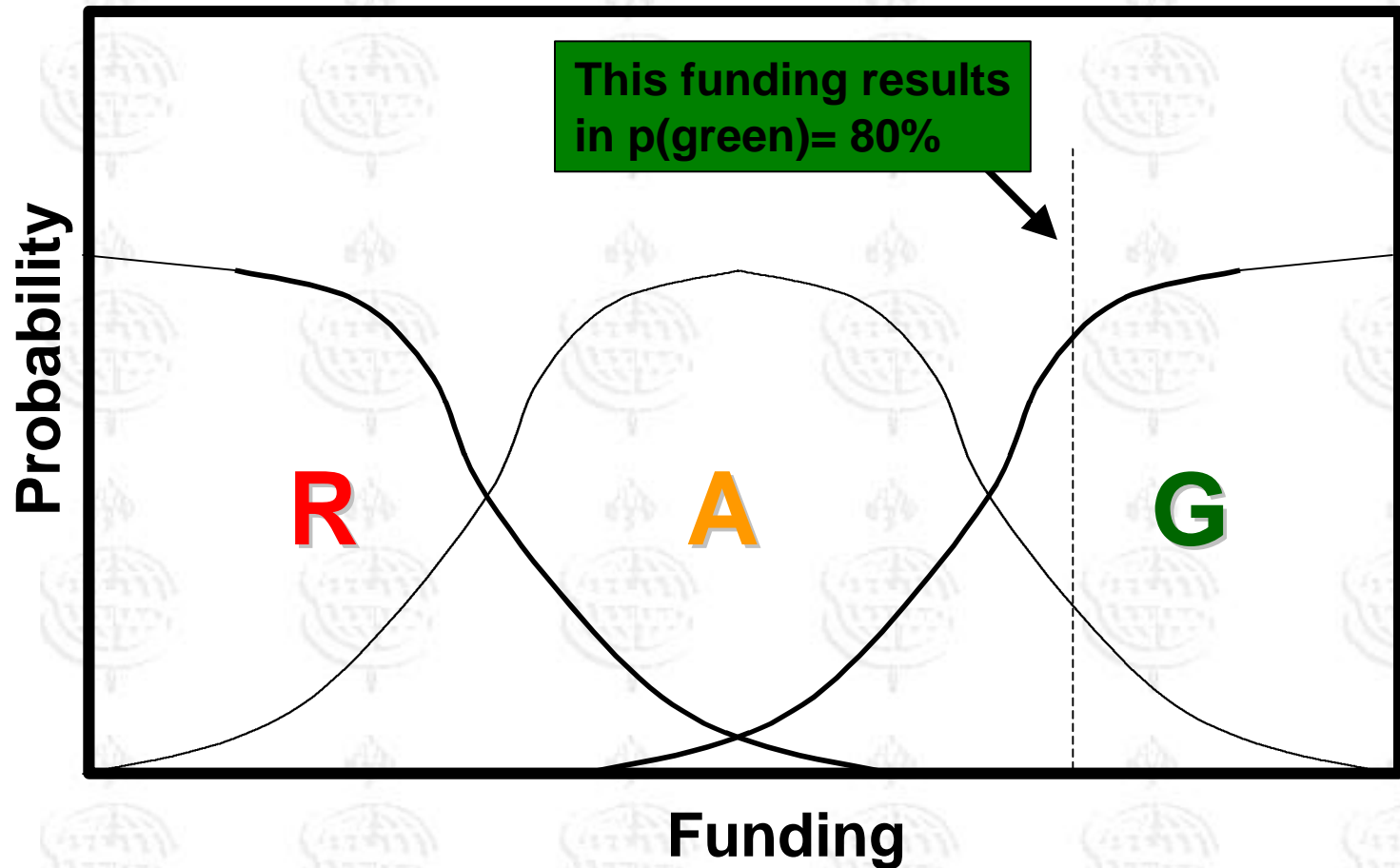x = Quantity ($\pm$ Attribute)
q = Quality Factor

Standard Service Cost Quantity - Quality Relationship

$ Cost

High Quality

SBC ($\overline{X}$)

a+q

Low Quality

q (quality)

b

a

1

x   Quantity

Standard Service Costing
Resource to the Standard

This funding results in p(green)= 80%

Probability

R   A   G

Funding

The *probability* of attaining a level of outcome given a funding level.

SSC Services Analyzed

95 Services

   - 12 Engineering Services

   - 4 Environmental Services

79 Services for CER Development

   - 5 Combined Civilian Personnel Services

74 SSC CERs

SSC CER Methodology

- ✓ **Normalize all SBC Data**
  - ✓ **Remove Regional Anomalies**
  - ✓ **Convert To Constant Dollars**

- ✓ **Parse Data by Service for Analysis**
  - • **Validate Data**
  - • **Exploratory Analysis**
  - • **Create Correlation Matrices**
  - • **Cost Estimating Relationship Analysis**
  - • **Model Selection**
 - • **Model Validation**

Three Year Data Set

SSC CER Methodology
Normalization

Factor	Inflation	Regional Adjustments	Pay Raise	Foreign Currency
Convert From	Non-pay Current Year $	Local Pay *Regional Construction*	Civilian Pay $	Local Currency
Convert To	Constant Year $	Standard Rate *National Standard*	Base Year Pay $	US Base Year $
Using	OSD Inflation Rates	Locality Pay Rate *Regional Construction Index*	Civilian Pay Raise Adj.	Budget Exchange Rates

SSC CER Methodology
Parse Data by Service for Analysis

- **Validate Data**
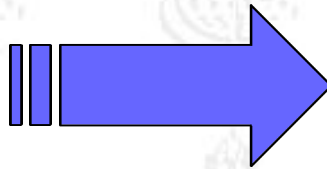
  - **Missing Data**
  - **Central Funds Reallocated**
  - **Coding Errors i.e. Unit of Measure**
  - **Censor Invalid Data**
  - **Review Appropriate Demographic Data**

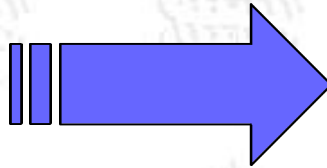- **Exploratory Analysis**

  - **Build S-Plus Data Object**
  - **Regress Cost Drivers vs Service Total Cost**
  - **Outlier Analysis**
  - **Censor Outliers**
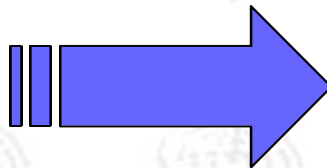
SSC CER Methodology
Parse Data by Service for Analysis

- **Create Correlation Matrices**

  ✓ **Data Segments**
    - **Installation / MACOM**
    - **CONUS/OCONUS**

  ✓ **Explore Cost Drivers**
    - **Primary & Demographic Measures**
    - **Combinations**
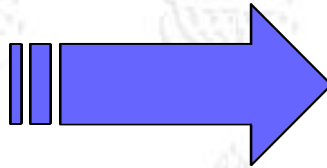
- **Cost Estimating Relationship Analysis**

  - **Univariate Linear Regressions**
  - **Multivariate Linear Regressions**
  - **Curvilinear Regressions**
  - **Interactive Regressions**
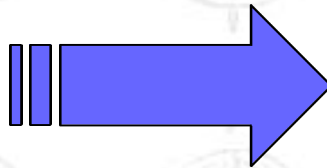
SSC CER Methodology
Parse Data by Service for Analysis

- **Model Selection**

  - **Choose Top Three Models**
  - **Evaluate R2 Statistic**
  - **Evaluate Cost Drivers; Logical Relationship**
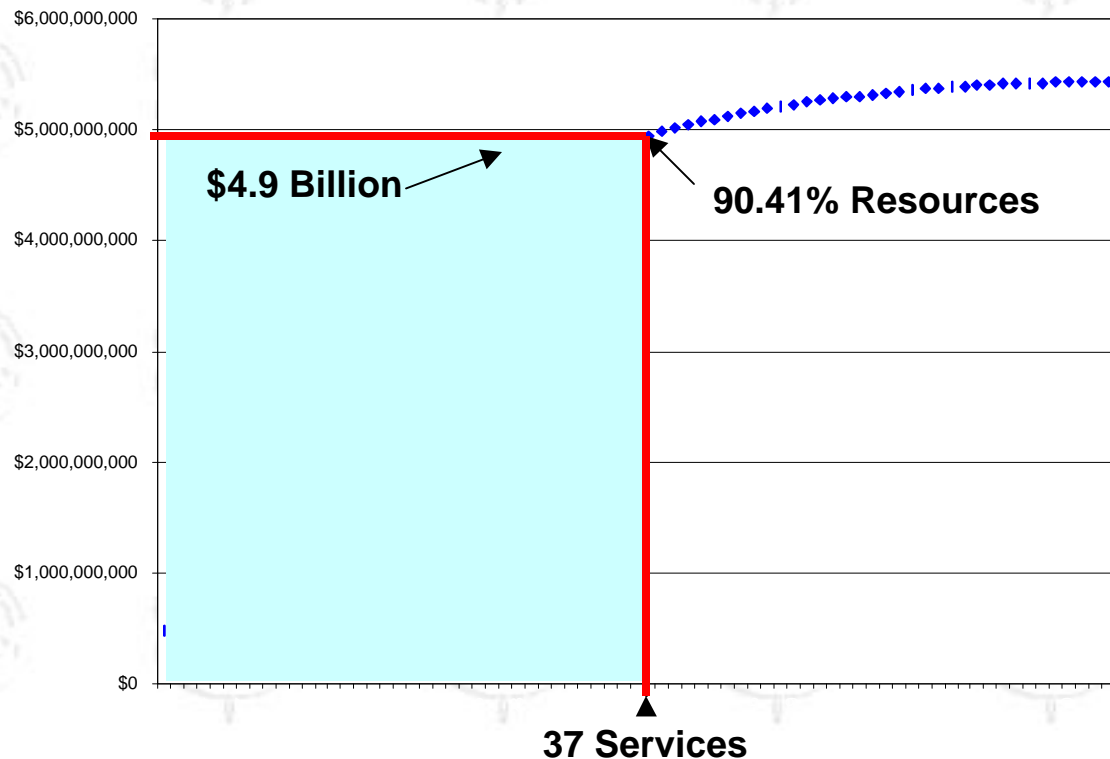 - **Review Alternate Views; Ensure Internal Consistency**

- **Model Validation**

  - **Plot Residuals vs Quantiles**
  - **Plot Studentized Residuals vs Predicted Values**
  - **Plot Cooks Distance vs Case Index**

Cumulative Resources by Service

Based on Full Cost

$4.9 Billion

90.41% Resources

37 Services

37 Service CER Represent 90% of Resources

Utility of SSC CERs

Usefulness Tests

✓ **T-test (Linear)**

✓ **F-test (Multivariate)**

Test Values Indicate the Relationship Between Service Cost and Cost Drivers; Test Is Performed for Every CER

All CER Results Fall Within the 95% Confidence Interval.

Usefulness Tests
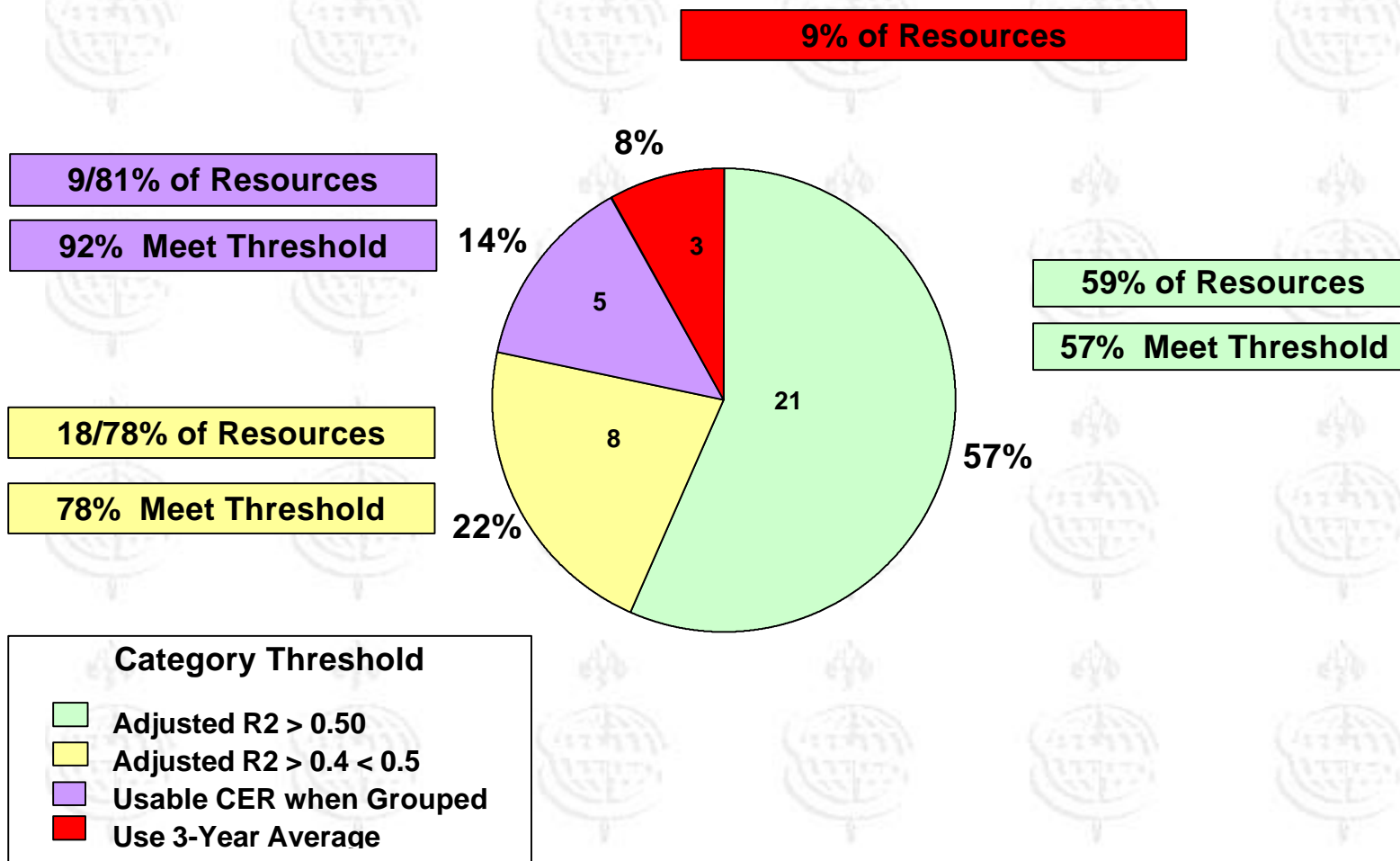## *Good Relationships, But Better R^2 Will Follow*

Current R^2 Values Explain 50-80% of Data Variation

Anticipate Future R^2 Values will Explain More Data Variation

T- and F-tests show we are on the right course

Results - 37 Service CERs
Quantity Only

9% of Resources

9/81% of Resources

92% Meet Threshold

8%

14%

18/78% of Resources

78% Meet Threshold

22%

3

5

21

8

57%

59% of Resources

57% Meet Threshold

Category Threshold

- Adjusted R2 > 0.50
- Adjusted R2 > 0.4 < 0.5
- Usable CER when Grouped
- Use 3-Year Average

U.S. Army Cost & Economic Analysis Center

Results - 22 of 37 Services With Quality
Impact of Quality to CERs

9% of Resources

No CER has Quality

9/81% of Resources

92% Meet Threshold

5 CERs have Quality

59% of Resources

57% Meet Threshold

14 CERs have Quality

18/78% of Resources

78% Meet Threshold

3 CERs have Quality

8%

14%

57%

22%

3

5

21

8

Category Threshold

Adjusted R2 > 0.50
Adjusted R2 > 0.4 < 0.5
Usable CER when Grouped
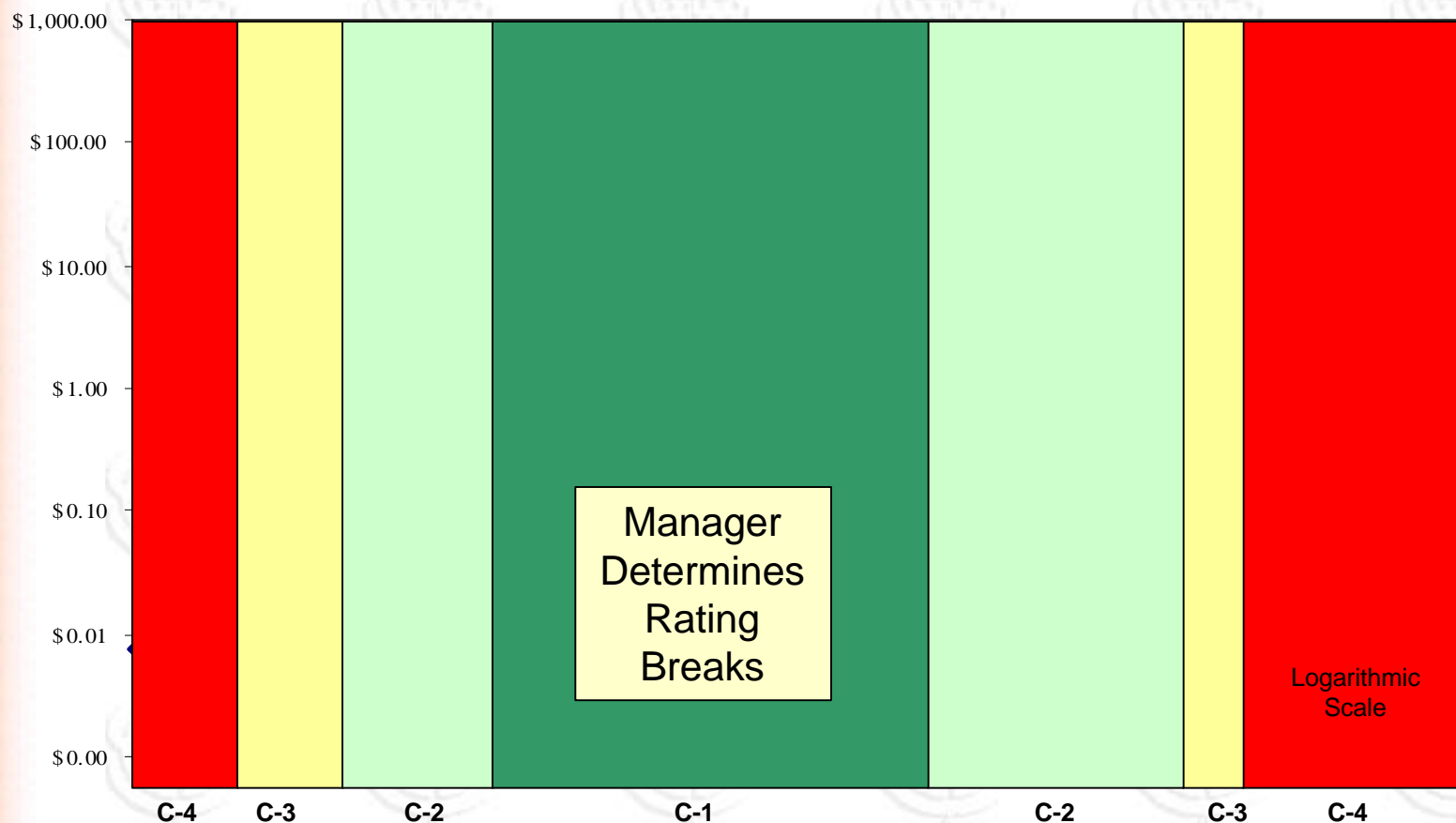Use 3-Year Average
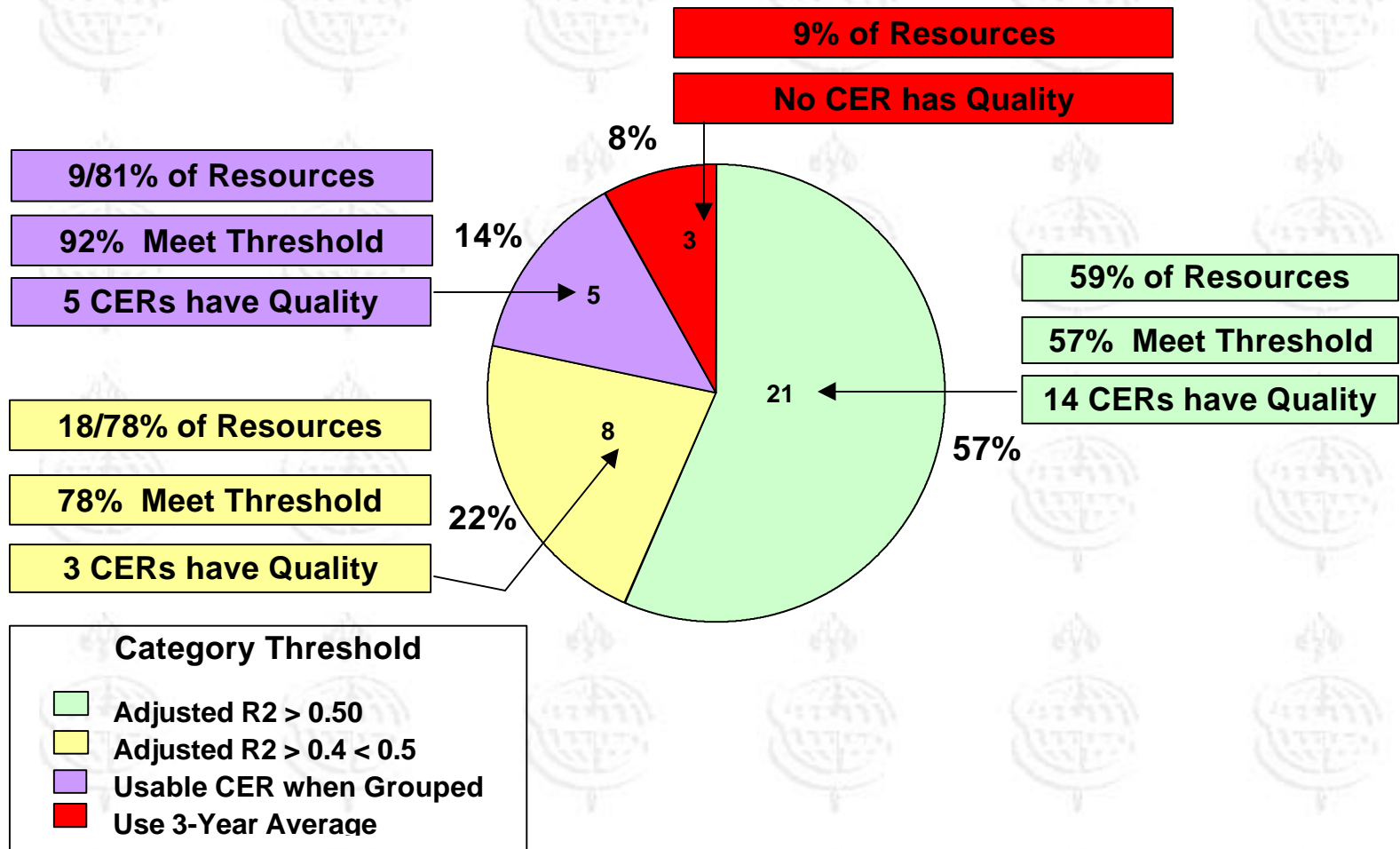
Setting Standards

A Management-assigned Rating Scale Placed Over the Performance Measurement Scale to Evaluate How Well Something Is Done.

Can Move—Does Not Depend on Scale

- **Metric** ➡️ **Yards**

- **Measure** ➡️ **9 yards**

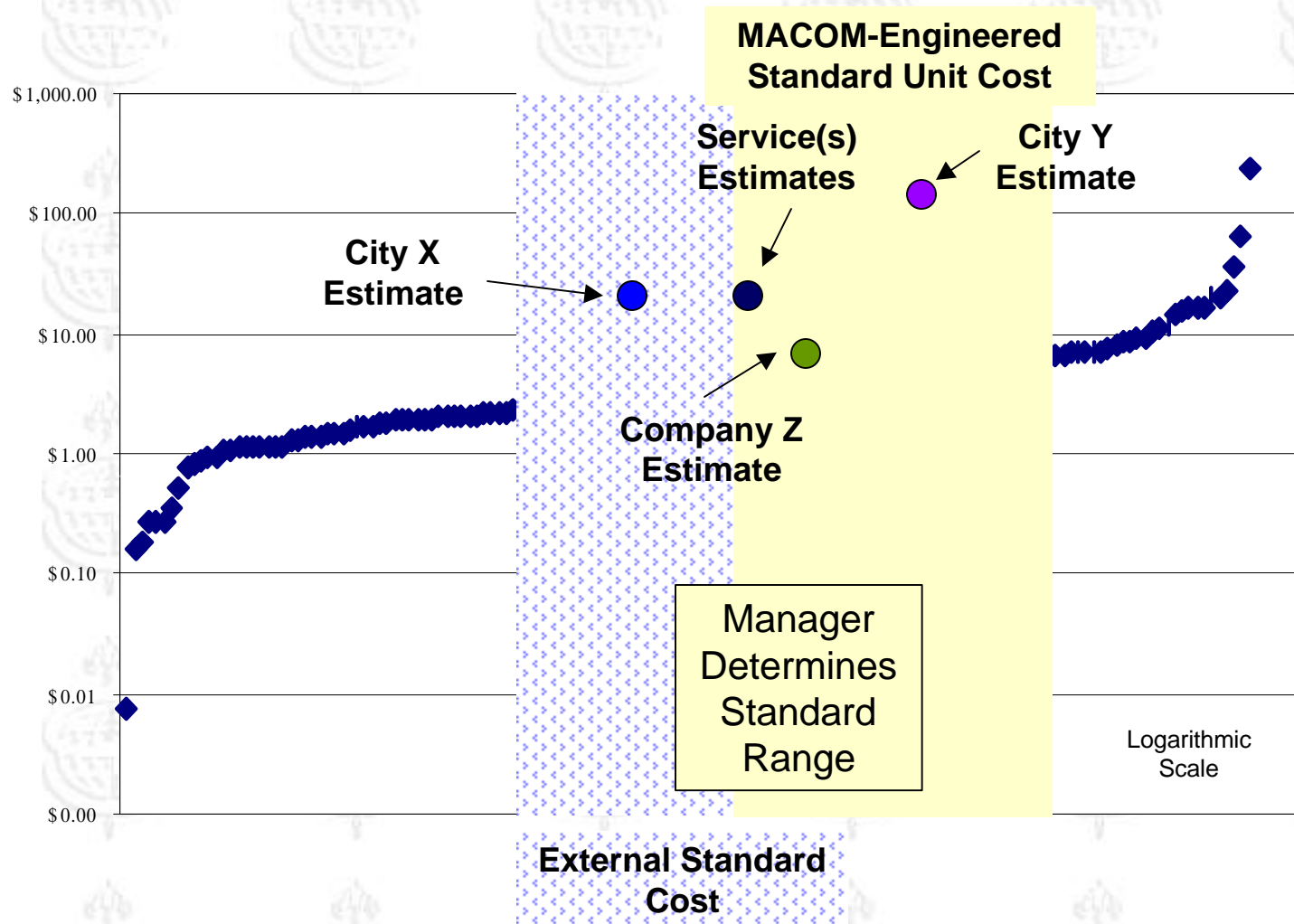- **Standard** ➡️ **10 yards For 1st Down**

Setting a Standard (Quality Only)
Benchmarking

Distribution of Food Service Unit Costs

MACOM-Engineered
Standard Unit Cost

Service(s)
Estimates

City Y
Estimate

City X
Estimate

Company Z
Estimate

Manager
Determines
Standard
Range

Logarithmic
Scale

External Standard
Cost

$1,000.00
$100.00
$10.00
$1.00
$0.10
$0.01
$0.00

Setting a Standard (Quality Only)
MACOM Agreement

Distribution of Food Service Unit Costs

MACOM 1
$5.35

MACOM 2
$6.57

MACOM 3
$7.50

Manager Determines Standard Range

Logarithmic Scale
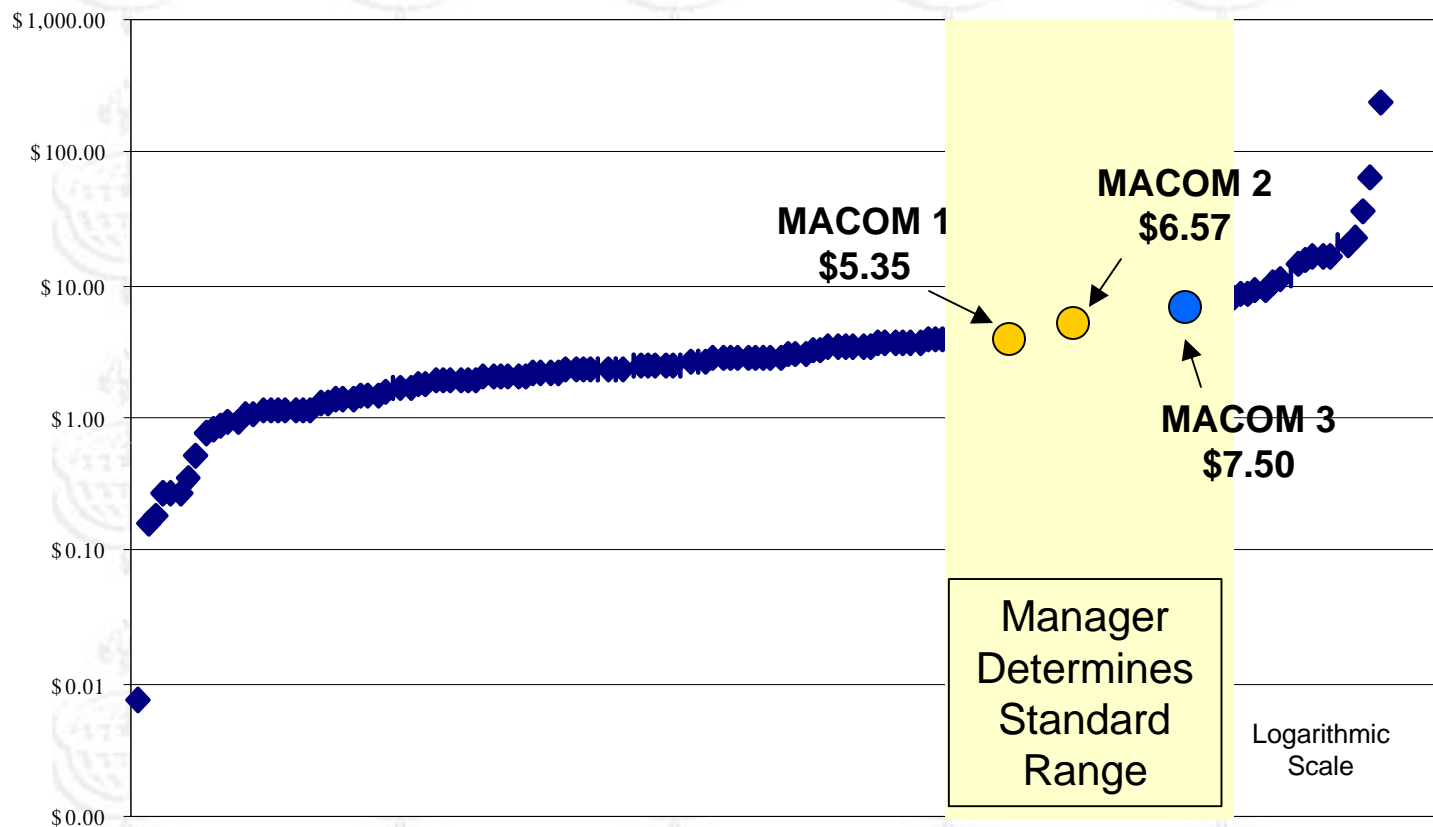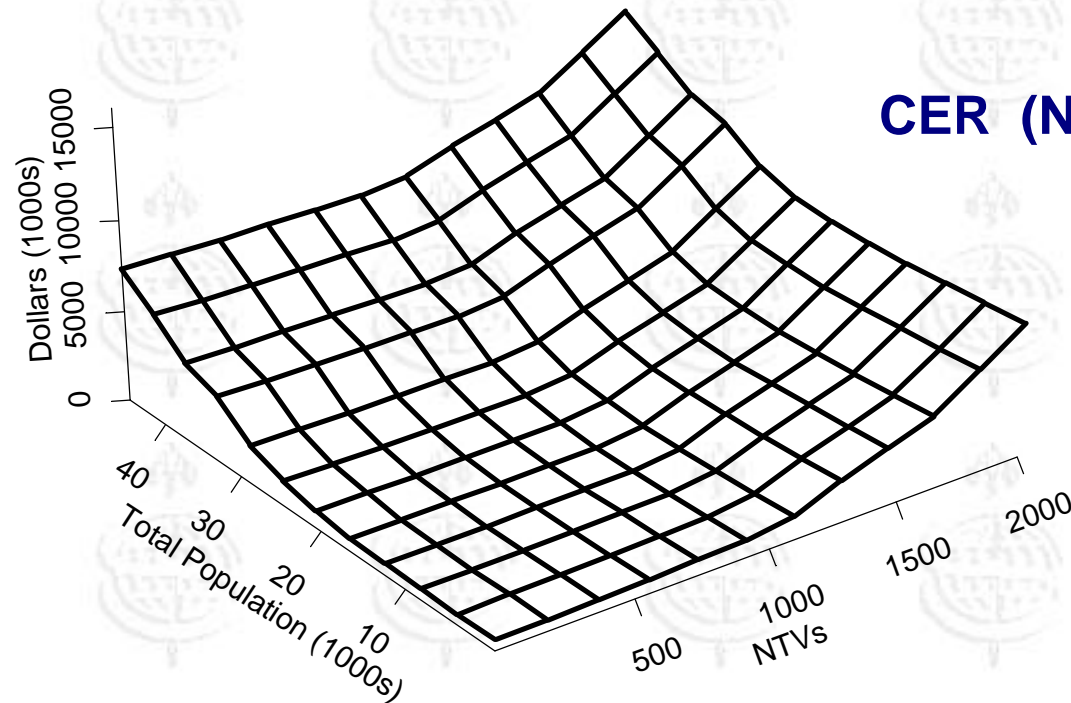
Standard Service Costing

Transportation Services

$Y = \$587{,}919 + \$3{,}369.68 \, (X_1) + \$151.78 \, (X_2)$

Y = Transportation Services Total Cost in FY99$

X_1 = Total number of installation owned and leased NTVs (SPM)

X_2 = Total Population

CER (No Quality)

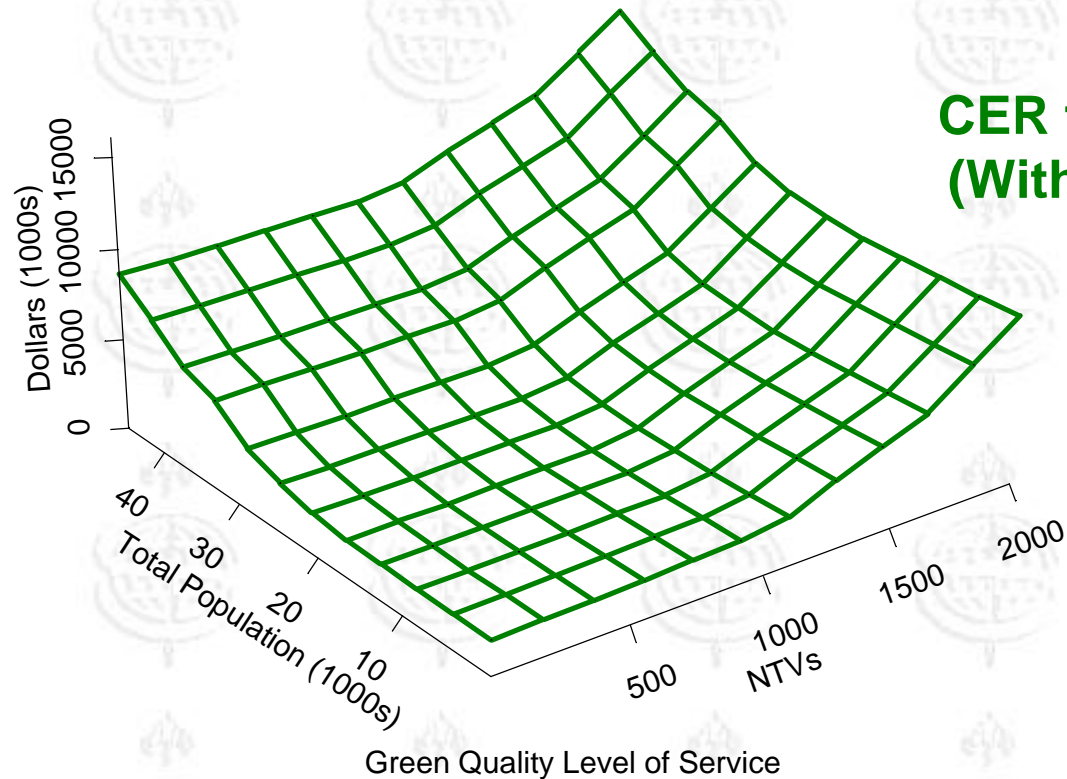No Quality

Standard Service Costing

Transportation Services

$$Y = \$194{,}130 + \$3{,}632.25\ (X_1) + \$148.78\ (X_2) + \$9{,}815.80\ (X_3)$$

Y = Transportation Services Total Cost in FY99\$

X_1 = Total number of installation owned and leased NTVs (SPM)

X_2 = Total Population

X_3 = Average duration Storage-in-Transit (days)

CER for Green
(With Quality)

Green Quality Level of Service

Standard Service Costing

Transportation Services

Green " 180 days	**Amber = 180-270 days**	**Red > 270 days**
Break Point = 180	**Median = 225**	**Break Point = 271**

Amber => Green

Difference: $442,000
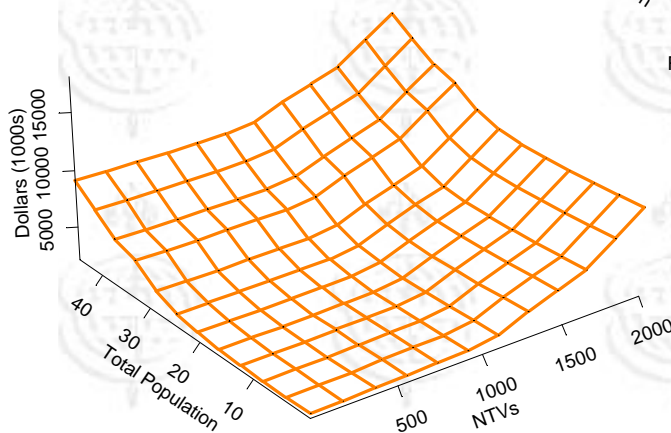
Red => Green
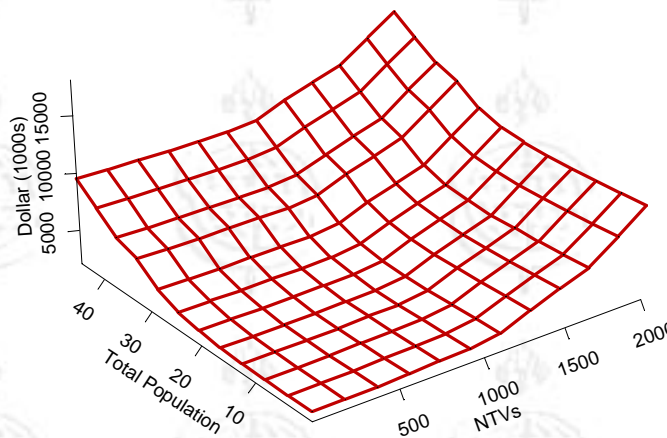
Difference: $893,238

RED Quality Level of Service

Amber Quality Level of Service
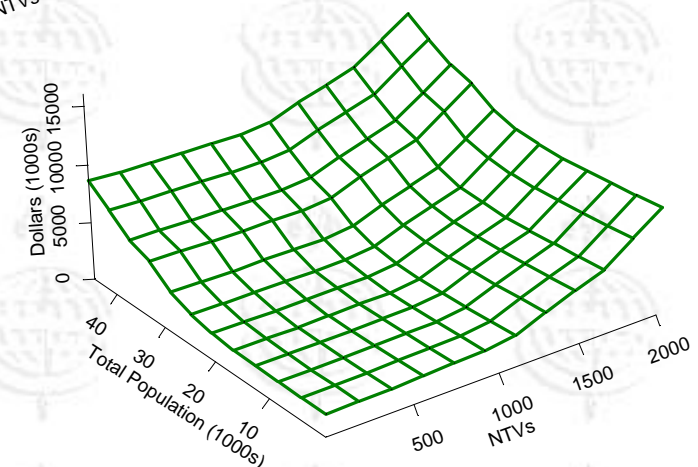
Green Quality Level of Service

SSC Use in ISR - Services

C 2 **C 1** **C 3**

Quality Cost Performance

Outcome Measures Related to Cost
- Performance against a standard
- Nature of quality rating is unique to each service
- Rating can address timeliness, frequency, speed, and/or quantity of service delivery

Outcome Measures NOT Related to Cost
- Management indicators
- External customer satisfaction
- Principal use by local commanders

Quantity Cost Performance

Cost Performance
- Evaluates actual costs against target costs
- Target costs from SSC developed CERs
  - Efficiency CERs based on past SBC data only
  - Quality CERs based on past SBC data and Quality ISR ratings
  - SBC data includes **Output Measures**

Management

SSC Use in ISR - Services
Family Housing Management

NA	C 1	C 3
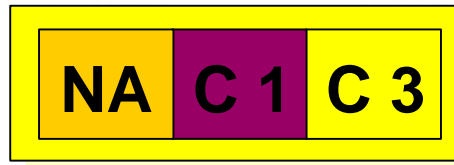
Quality Cost Performance

- **None Identified**

Quantity Cost Performance

- CER Unit Cost Target AFH Units 1,440
- Actual Service Cost Captured
- C-rating based on Actual Costs to CER Target Costs
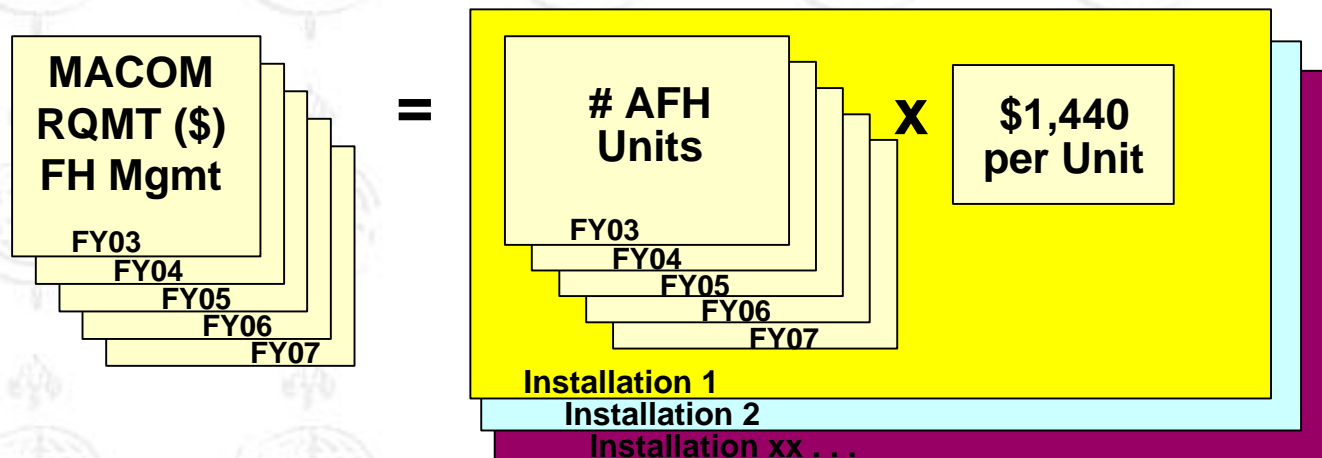
C-1 Standard

- Business Occupancy Program (BOP) rate — 94%
- % occupancy of leased housing — 94%
- Avg # days awaiting on-post housing — < 30 days

Management

SSC Use in AIM-HI - Services
Family Housing Management

Program Requirement for Family Housing Management

| MACOM RQMT ($) FH Mgmt | = | # AFH Units | X | $1,440 per Unit |

FY03
FY04
FY05
FY06
FY07

FY03
FY04
FY05
FY06
FY07

Installation 1
Installation 2
Installation xx . . .

SSC Use in ISR - Services
Transportation Services

C 2	C 1	C 3

Quality Cost Performance

- Avg Duration Destination Storage-in-Transit
- C-1 Standard - 180 days

Quantity Cost Performance

- CER Unit Cost Target
- Non-Tac Vehs $12,302
- Total Population $222
- Actual Cost Captured
- C-rating based on Actual to Target Costs

Management

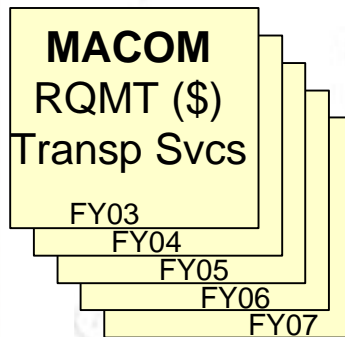|	C-1 Standard
• % Cargo Shipments Picked up on Schedule	95%
• % Cargo Shipments Delivered on Schedule	95%
• % Outbound Personal Prop Shipments Picked up on Schedule	98%
• % Inbound Personal Prop Shipments Delivered on or Before Schedule	95%
• % Non-tactical Vehicle Requests Filled	90%

SSC Use in AIM-HI - Services
Transportation Services

U.S. Army Cost & Economic Analysis Center

MACOM
RQMT ($)
Transp Svcs

FY03
FY04
FY05
FY06
FY07

Program Requirement for Transportation Services

=

Non-Tac Vehs

FY03
FY04
FY05
FY06
FY07

X

$12,302 per Veh

+

$222 per PN

X

Total Population

FY03
FY04
FY05
FY06
FY07

Installation 1
Installation 2
Installation xx . . .
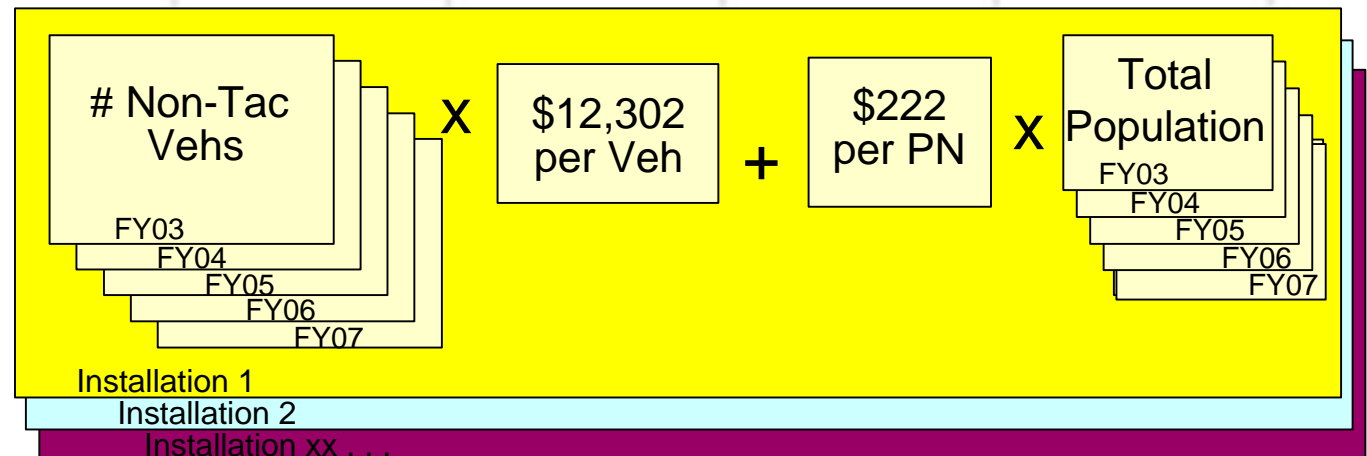
Next Steps

✓ **Use CERs (37) for POM 03-07 Analysis / Validation – Parallel Test in AIM-HI Model**

✓ **Work To Improve Data Reporting & Metrics**

✓ **Work With DA & Field Managers To Set Affordable Standards**

✓ **Focus on DA Selected Top 13 Services That Directly Impact on Transformation and Well Being (Significant $'s 20.3%)**

✓ **Analysis of Selected Top 13 CERs With new Data**

✓ **Full CER Review With May Field Data**